LETTER OF TRANSMITTAL

Arthur L. Russnow, CPG
CONSULTING HYDROGEOLOGIST
GRAHAM DRIVE, NEWPORT NEWS, VA., 23606
PHONE; 757-532-0598

Date 10/7 Job No. 403F

Attention

Re: IFL-Mappsville, Va Plant

RECEIVED – DEQ
OCT 08 2014
Tidewater Regional Office

TO: Mr. Robert E. Smithson, Jr.
Env. Specialist Senior
VA DEQ TRO
5636 Southern Blvd.
Virginia Beach, Va 23462

WE ARE SENDING YOU X Attached ___ Under separate cover via ______ the following items:

___ Shop drawings ___ Prints ___ Plans ___ Samples ___ Specifications

___ Copy of Letter ___ Change Order ___ Other ______

Copies	Date	No.	Description
3	10/7/14		VPA Application-Part C-11

THESE ARE TRANSMITTED AS CHECKED BELOW:

___ For approval ___ Approved as submitted ___ Resubmit ___ copies for approval

X For your use ___ Approved as noted ___ Submit ___ copies for distribution

X As requested ___ Returned for corrections ___ Return ___ corrected prints

___ For review and comment ___ Other ______

___ FOR BIDS DUE ______ 20___ ___ PRINTS RETURNED AFTER LOAN TO US

REMARKS: ______

COPY TO ______

SIGNED Arthur L. Russnow

INTEGRATED FISHERIES INTERNATIONAL,LTD.
13249 LANKFORD HIGHWAY(ROUTE 13)
MAPPSVILLE, VA 23407

REAPPLICATION FOR VPA PERMIT NO. VPA 01060

SEPTEMBER 2014
W.O.# 4038

Arthur L. Russnow, CPG
CONSULTING HYDROGEOLOGIST
25 GRAHAM DRIVE, NEWPORT NEWS, VA., 23606
PHONE; 757-532-0598

FORM A

VIRGINIA POLLUTION ABATEMENT PERMIT APPLICATION
FORM A
ALL APPLICANTS

1. Facility Name: INTEGRATED FISHERIES INTERNATIONAL, LTD.

County and Location: Accomack Co., roughly bounded by Rts. 13, 691, 689, and 679

Address: P.O. Box 38 - 13249 Lankford Highway

Mappsville, VA 23407

2. Legal Name of Owner: INTEGRATED FISHERIES INTERNATIONAL, LTD.

Address: P. O. Box 38, Mappsville, VA 23407

Telephone Number: (804) 824-5651

3. Facility Contact: JOHN MILLER

Title: SR. VP.-OPERATIONS

Address: (if different) Same

Telephone Number: (804) 824-5651

RECEIVED – DEQ
SEP 03 2014
Tidewater Regional Office

4. Existing Permits (e.g., IW ND, VPA, NPDES; RCRA; UIC; PSD; other:

Agency	Permit Type	Number
DEQ-Water	VPA	VPA 01060
DEQ-Water	GW Withdrawal	ES-142 not yet re-issured

5. Nature of Busnineess: Seafood Processing

SIC Code(s) 2092 ; ;

6. Type of Waste: (check blank as appropriate)

	Proposed	Existing
Animal Waste (complete Form B)		
Industrial Waste (complete Form C)		X
Sewage Effluent (complete Form D, Part II)		
Sewage Sludge Infrequent Land Application (complete Form D, Part II		
Sewage Sludge Frequent Land Application (complete Form D, Part III		

7. General Location Map:

Provide a general location map which clearly identifies the location of the facility.

I certify under penalty of law that this document and all information submitted were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is to the best of my knowledge true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations. I further certify that I am an authorized signatory as specified in the permit Regulation (VR680-14-01).

Signature: John Miller Date: 9/2/14

Printed Name: John Miller

Title: SR. VP Operations

FIGURE 1
SITE LOCATION MAP

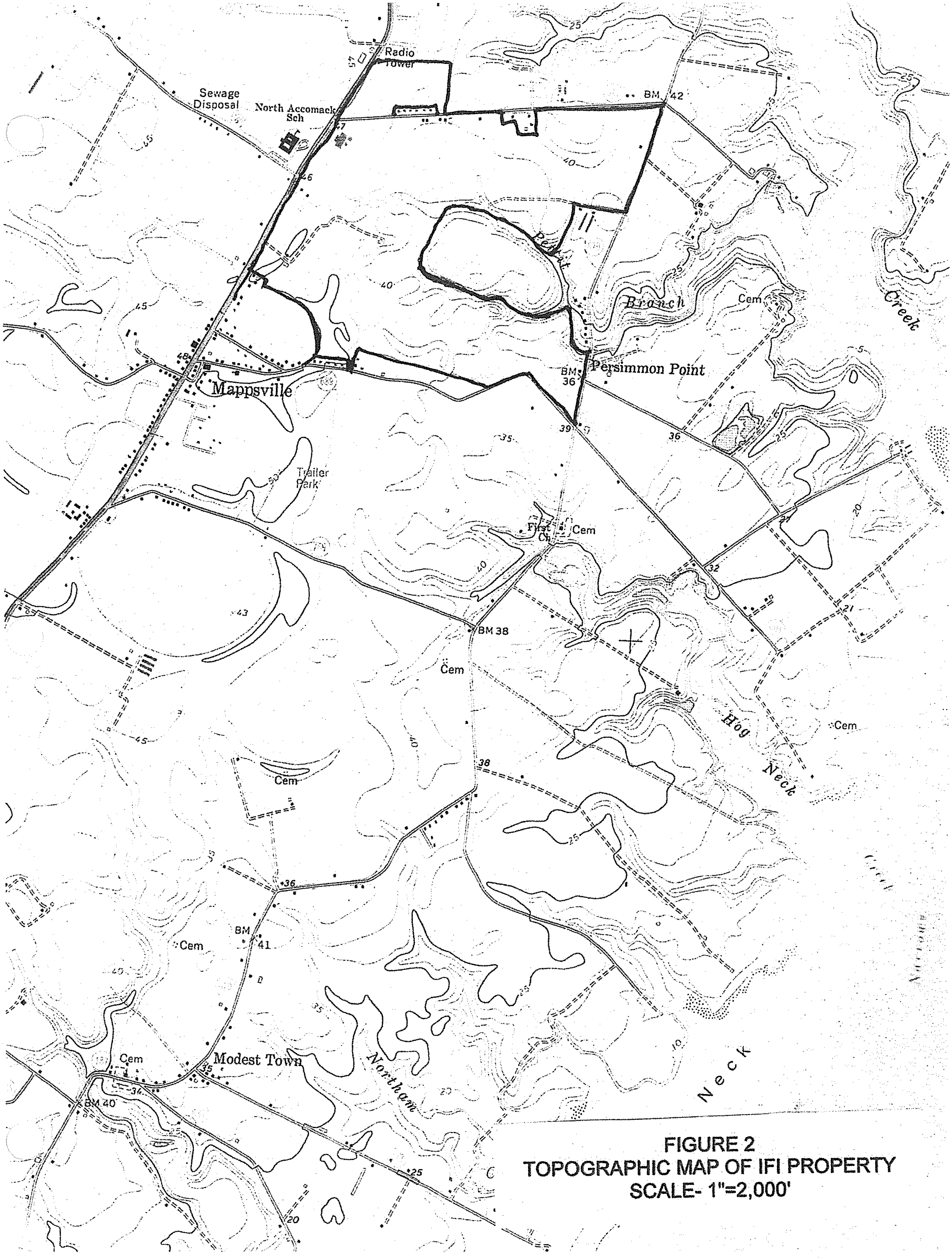


FIGURE 2
TOPOGRAPHIC MAP OF IFI PROPERTY
SCALE- 1"=2,000'

FORM C

VIRGINIA POLLUTION ABATEMENT PERMIT APPLICATION

FORM C

INDUSTRIAL WASTE

PART C-1 General Information

1. Facility Name: INTEGRATED FISHERIES INTERNATIONAL, LTD

2. Source(s) of Waste

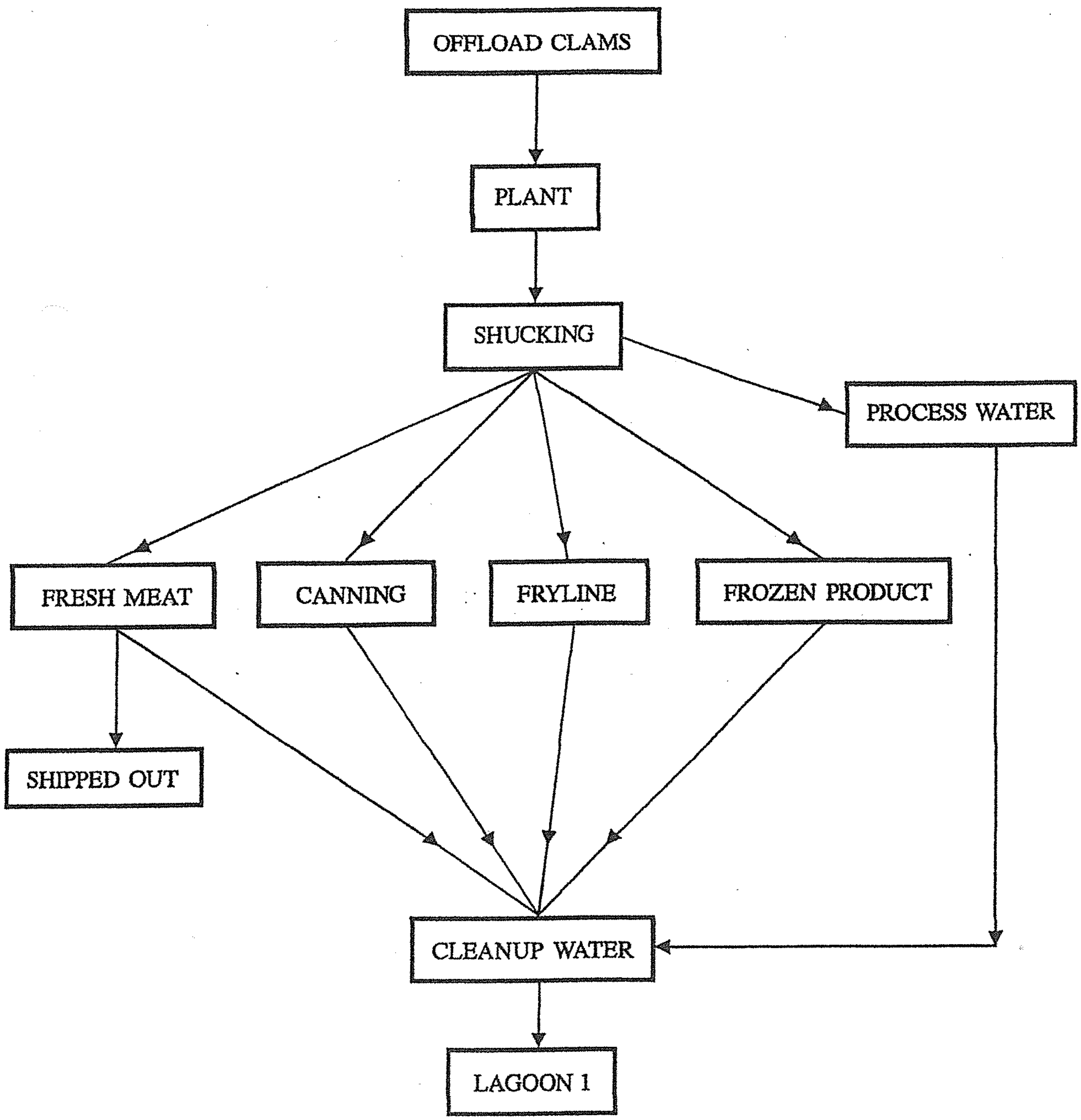
   a. *Provide a narrative which explains your facility operations and how wastes are produced.*

      Clam shucking, canning, freezing, and frying. Waste includes workarea washdown water.

   b. *Attach a line drawing of the facility in block diamgram for showing the manufacturing or processing opeations and all points where wastes are produced.*

   c. *Explain how sewage from employees is handled (i.e., septic tank/drainfield, sanitary sewer etc.):*

      Septic tank/drainfield



RKA

DAILY PLANT OPERATIONS
INTEGRATED FISHERIES INTERNATIONAL, INC.
MAPPSVILLE, VIRGINIA

NOT TO SCALE

d. *Operational Parameters*

Maximum hours/day of operation: __22__________________________
Average hours/day of operation: __19__________________________
Days/week of operation: __3.5 (annual average)__________
Specific months of operation: __year round__________________

3. Non-Hazardous Declaration

a. *Statement for Plant Operations*

Is any part of the manufacturing operations, plant processes or waste treatment facilities at these plant facilities under the purview of the "Virginia Hazardous Waste Management Regulations" or the "Virginia Solid Waste Management Regulations?"
________*Yes* ___X___*No*

If Yes, please provide a brief explanation of the type of permit or requirements that apply.

b. *For waste to be land applied, a responsible person, as defined by VR680-14-01, must sign the following statement.*

I certify that the waste described in this application is non-hazardous and not regulated under the Resource Conservation and Recovery Act.

John Miller Date 9/2/14
(Signature of Owner)

4. Waste Characterization See previously submitted data and data in attached irrigation report. Also see data contained in Appendix C.

a. *Wastewater - Provide at least one analysis for each parameter. Upon review, additional analyses may be required by DEQ.* 2/13/2008 Sample Date

Parameter	Concentration	
Flow to treatment	250-350,000 gpd	MGD operational day
Flow to storage	variable	MGD
Vol. to Treatment		MG
Vol. to storage		MG
Vol. Land applied		MG/year
BOD_5		mg/l
COD		mg/l
TOC		mg/l
TSS		mg/l
Percent Solids		%
pH		S.U.
Alkalinity as $CaCO_3$		mg/l
Nitrogen, (Nitrate)	1.43	mg/l
Nitrogen, (Ammonium)	1.81	mg/l
Nitrogen, (Total Kjeldahl)	12.43	mg/l
Phosphorous, (Total)	71.26	mg/l
Potassium, (Total)		mg/l
Sodium	189.4	mg/l
CHLORIDE	293.5	mg/l

b. *Sludge - Provide at least one analysis for each parameter. Upon review, additional analyses may be required by DEQ.* Not Applicable

Parameter	Concentration*	
Percent Solids		%
Volatile Solids		%
pH		S.U.
Alkalinity as $CaCO_3$**		mg/kg
Nitrogen (Nitrate)		mg/kg
Nitrogen (Ammonium)		mg/kg
Nitrogen (Total Kjeldahl)		mg/kg
Phosphorous (Total)		mg/kg
Potassium (Total)		mg/kg
Lead		mg/kg
Cadmium		mg/kg
Copper		mg/kg
Nickel		mg/kg
Zinc		mg/kg

* Unless otherwise noted, report results on dry weight basis.

** Lime treated sludges (10% or more lime by dry weight) should be analyzed for percent $CaCO_3$.

c. *Provide a separate waste characterization listing for each wastewater and sludge generated at the facility. Insert "Yes" beside all parameters believed present and providce at least one analysis for each. Insert "No" beside all parameters believed not present. Indicate "NA" for any parameter already addressed in Item 4a. or 4b.*

Parameter	Believed Present (yes or no)	Concentration*
Sodium	X	189.4 mg/L
Bromide	No	
Total Residual Chlorine		
Fecal Coliform		
Fluoride		
Oil & Grease		
Total Radioactivity		
Total Alpha		
Total Beta		
Total Radium		
Total Radium 226		
Sulfate (as SO_4)		
Sulfide (as S)		
Sulfite (as SO_3)		
Surfactants		
Total Aluminum		
Total Barium		
Total Boron		
Total Cobalt		
Total Iron		
Total Magnesium		
Total Moybdenum		
Total Manganese		
Total Tin		
Total Titanium		
Total Antimony		
Total Arsenic		
Total Beryllium		
Total Cadmium		
Total Copper		
Total Lead		
Total Mercury		
Total Nickel		
Total Selenium		
Total Silver		
Total Thallium		
Total Zinc		
Total Cyanide	no	
Total Phenols	no	
Dioxin	no	
Acrolein	no	

* If the analysis is for sludge, report results on dry weight basis.

c. (Continued)

Parameter	Believed Present (yes or no)	Concentration
Acrylonitrile	All No	
Benzene		
Bis(Chloromethyl)Ether		
Bromoform		
Carbon Tetrachloride		
Chlorobenzene		
Chlorodibromomethane		
Chloroethane		
2-Chloroethylvinyl Ether		
Chloroform		
Dichlorobromomethane		
Dichlorodifluoromethane		
1,1-Dichloroethane		
1,2-Dichloroethane		
1,1-Dichloroethylene		
1,2-Dichloropropylene		
1,3-Dichloropropylene		
Ethylbenzene		
Methyl Bromide		
Methyl Chloride		
Methylene Chloride		
1,1,2,2-Tetrachlorethane		
Tetrachloroethylene		
Toluene		
1,2-TransDichloroetheylene1		
1,1-Trichloroethane		
1,1,2-Trichloroethane		
Trichloroethylene		
Trichlorofluoromethane		
Vinyl Chloride		
2-Chlorophenol		
2,4-Dichlorophenol		
2,4-Dimethylphenol		
4,6-Dinitro-O-Cresol		
2,4-Dinitrophenol		
2-Nitrophenol		
4-Nitrophenol		
P-Chlor-M-Cresol		
Pentachlorophenol		
Phenol		
2,4,6-Trichlorophenol		
Acenaphthene		
Acenaphtylene		
Acenaphtylene		
Benzidine		
Benzo(a)Athracene		
Benzo(s)Pyrene		
3,4-Benzofluoranthene		
Benzo(ghi) Perylene		
Benzo(k)Fluoranthene		
Bis(2-Chloroethoxy)Methane		
Bis(2-Chloroethyl) Ether		
Bis(2-Chloroisopropyl)Ether		
Bis(2-Ethylhexyl)Phthalate		
4-Bromophenyl Phenyl Ether		
Butyl Benzyl Phthalate		
4-Chlorophenyl Phenyl Ether		
2-Chloronaphthalene		
Chrysene		
Dibenzo(a,H) Anthracene		

c. (Continued)

Parameter	Believed Present (yes or no)	Concentration
1,2-Dichlorobenzene	All No	
1,3-Dichlorobenzene		
1,4-Dichlorobenzene		
3,3'-Dichlorobenzidine		
Diethyl Phthalate		
Dimethyl Phthalate		
Di-N-Butyl Phthalate		
2,4-Dinitrololuene		
2,6-Dinitrololuene		
Di-N-Octyl Phthalate		
1,2-Diphenythydrazine(as Azobenzene)		
Fluoranthene		
Fluorene		
Hexachlorobenzene		
Hexachlorobutadiene		
Hexachlorocyclopentadiene		
Hexachloroethane		
Indeno(1,2,3-cd)Pyrene		
Isophorone		
Naphthalene		
Nitrobenzene		
N-Nitrosodimethylamine		
N-Nitrosodi-N-Propylamine		
N-Nitrosodiphenylamine		
Phenanthane		
Pyrene		
1,2,4 - Trichlorobenzene		
Aldrin		
a-BHC		
B-BHC		
y-BHC		
- BHC		
Chlordane		
4,4'-DDT		
4,4'-DDE		
4,4'-DDD		
Dieldrin		
a-Endosulfan		
B-Endosulfan		
Endosulfan Sulfate		
Endrin		
Endrin Aldehyde		
Heptachlor		
Heptachlor Epoxide		
PCB - 1242		
PCB - 1254		
PCB - 1221		
PCB - 1232		
PCB - 1248		
PCB - 1260		
PCB - 1016		
Toxaphene		
Chloromethane		
Chlorpyrifos		
Demeton		
Dichloromethane		
(2,4-dichlorophenoxy) acetic acid (2,4-D)		
Di-2-Ethylhexyl Phthalate		
MBAS		

c. (Continued)

Parameter	Believed Present (yes or no)	Concentration
Lindane	All No	
Hydrogen Sulfate		
Silvex		
Tributyltin		
Kepone		
Malathion		
Methoxyclor		
Mirex		
Monochlorobenzene		
Parathion		

d. *Provide a separate waste chacterization listing for each wastewater and sludge generated at the facility. Lits any additional parameters believed present in the spaces provided below and provide at least one analysis for each.* None

Parameter	Concentration

5. Briefly describe the design and provide a line drawing of the waste treatment facility which relates the various components of the treatment system including source(s), treatment unit(s), disposal alternatives, and flow estimates from the various process units.

Wastewater flows to 4.5 MG AERATED LAGOON (Pond #1) which over-flows to Aerated Lagoon (4.5 MG Pond #2). TREATED Wastewater is pumped from Pond #2 to spray Irrigation pivots or to anerobic 15.5 MG Lagoons (Ponds # 3&4) for storage. Average daily operational flow is 250-350,00. Wastewater can also be pumped from Ponds # 3&4 to irrigation points.

6. Indicate the number and type of waste storage facilities. If existing, indicate the volume; DEQ may require additional information upon review.

No.		Existing (Volume)	Proposed
___ Earthen Storage Pond		________	________
___ Storage Pit		________	________
___ Storage Tank		________	________
_2_ Anaerobic Lagoon		15.5 MG Each	________
_2_ Other	Aerated lagoon	4.5 MG Each	________
	____________	________	________

7. Have the existing storage/treatment facilities identified in Item 5 and 6 above been previously approved by the Department of Environmental Quality?
Yes __x____ No _____

If yes, provide the date of the approval and proceed to Item i.
Approval Date: Various dates

If no, provide information required by Items 9, 10, and 11.

8. Have the previously approved facilities been altered or expanded?
Yes _____ No___x____

If yes, it will be necessary to provide the information for such facitilies, as required by Items 9 & 10, and 11.

If no, proceed to Item 12.

9. Provide conceptual design for the treatment facilities including design approach used. Explain how groundwater will be protected. Demonstration should include soil evaluation, geology, hydrology, and topography. The following information must be provided for each proposed facility identified in Item 6 above and for those existing facilities in Items 7 and 8 which have not been either previously approved or were altered:

a. *Design calculations for volume (ft^3) and estimated days of storage*
Design calculations previously submitted. Pond 1 & 2 -15 days each; Pond 3 & 4 - 60 days each.
b. *Description of lining material and permeability*
Synthetic Liners. Data previously submitted.
c. *Plan and cross-sectional views* - previously submitted

d. *Depth to seasonal high watertable and separation to permanent watertable.*
Data previously submitted with construction proposals at various times

10. Will the proposed waste storage/treatment facilities be located within the 100-year flood plain? ______Yes ____x___ No

If yes, what is the elevation of the 100-year flood plain and elevation of the proposed facilities. Also, how will the waste storage facilities be protected from flooding? (Flood elevation can be obtained from your local county zoning/planning department).

____
____
____
____
____
____
____
______

11. Will the proposed or existing storage/treatment facilities receive any stormwater runoff? ______ Yes ______ No x

If yes, provide total area (square feet, acres, etc.) from which runoff will occur and indicate this area on the line drawing (Item 5).

Total area: ________________________
Dimensions: ________________________

12. Will any of the waste generated at your facility be land applied? Yes_x____ No_____. If yes, Part C-11 must be completed.

FIGURES & RELATED INFORMATION

FIGURE 1
SITE LOCATION MAP

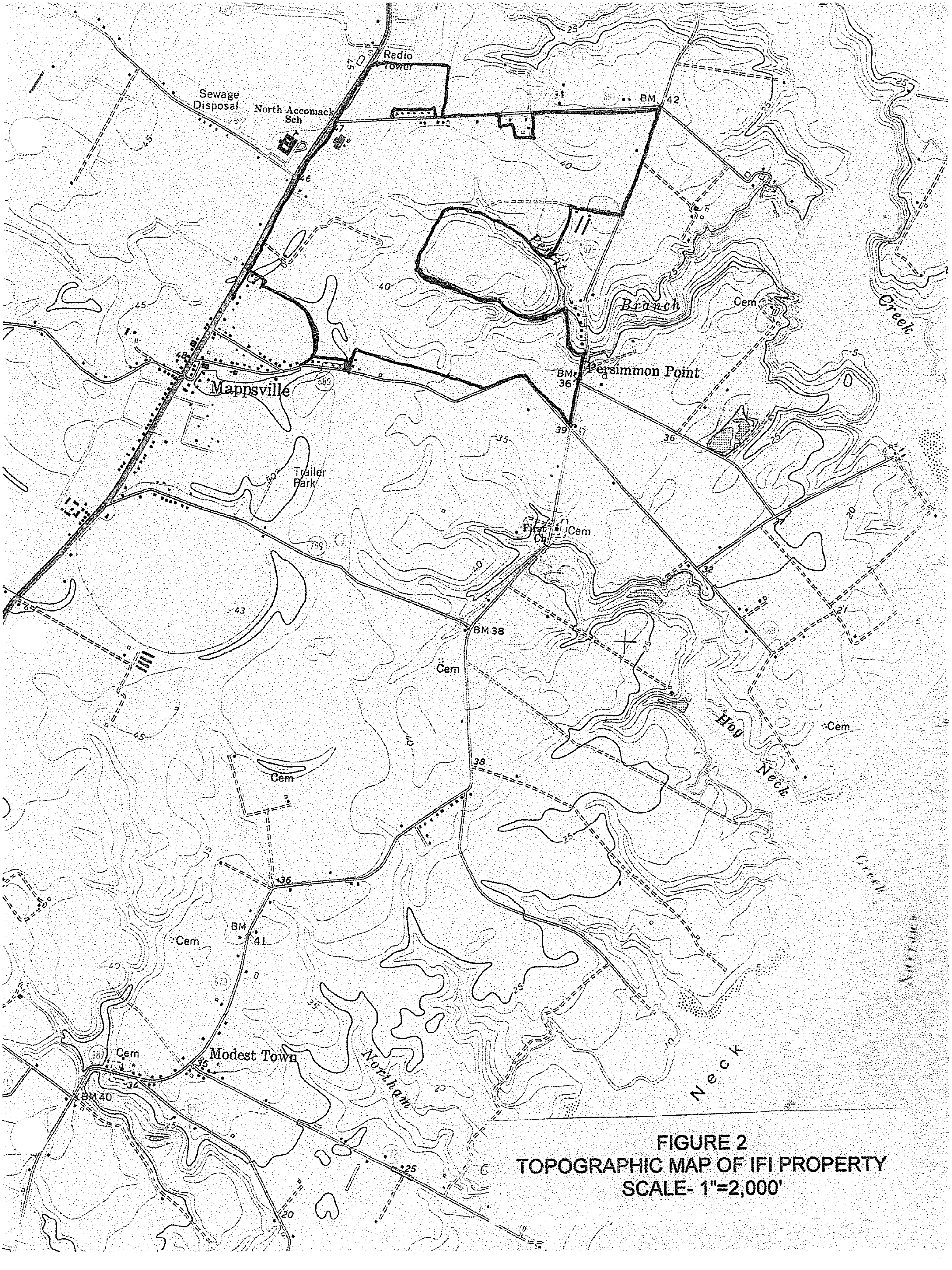


FIGURE 2
TOPOGRAPHIC MAP OF IFI PROPERTY
SCALE- 1"=2,000'

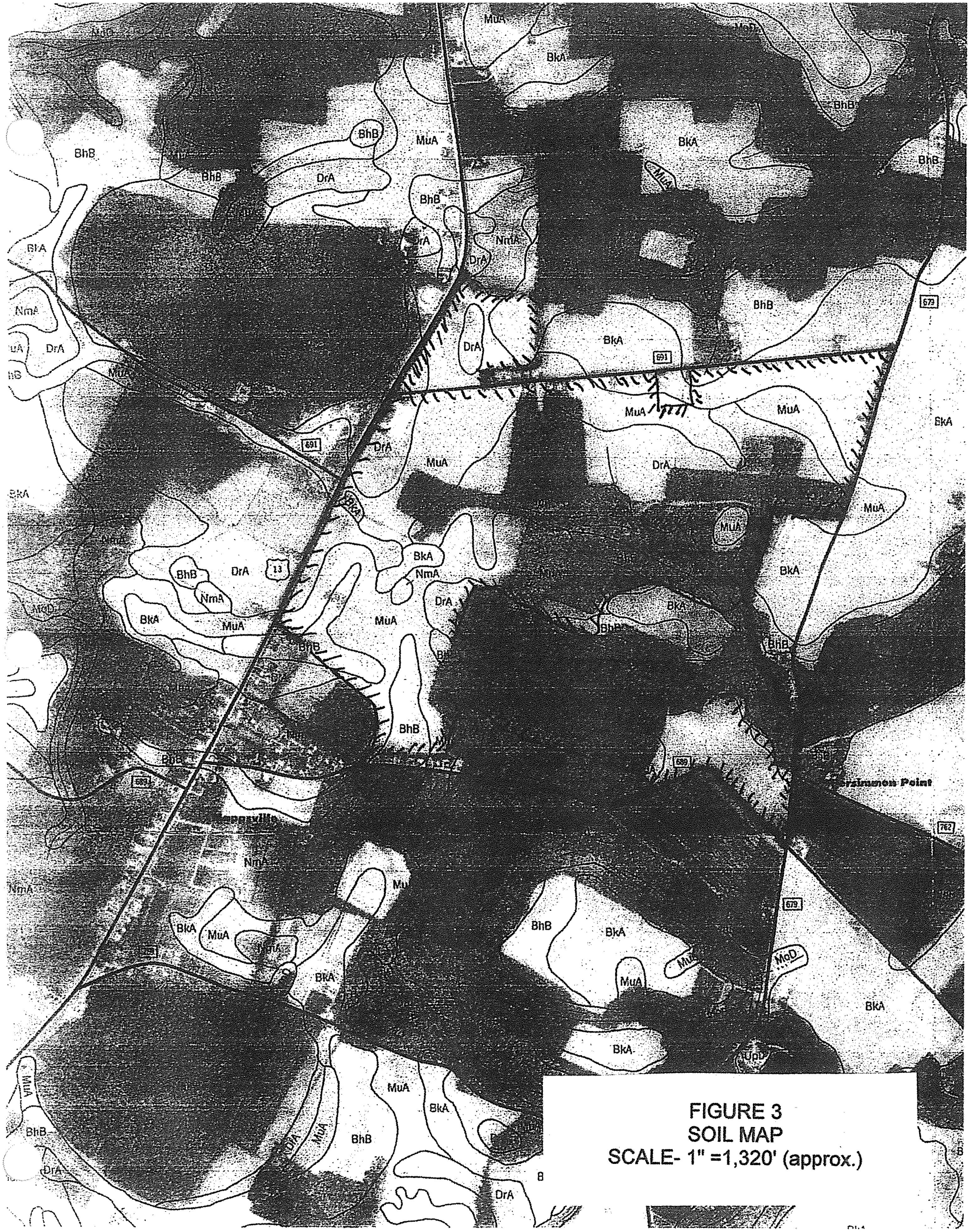


FIGURE 3
SOIL MAP
SCALE- 1" =1,320' (approx.)

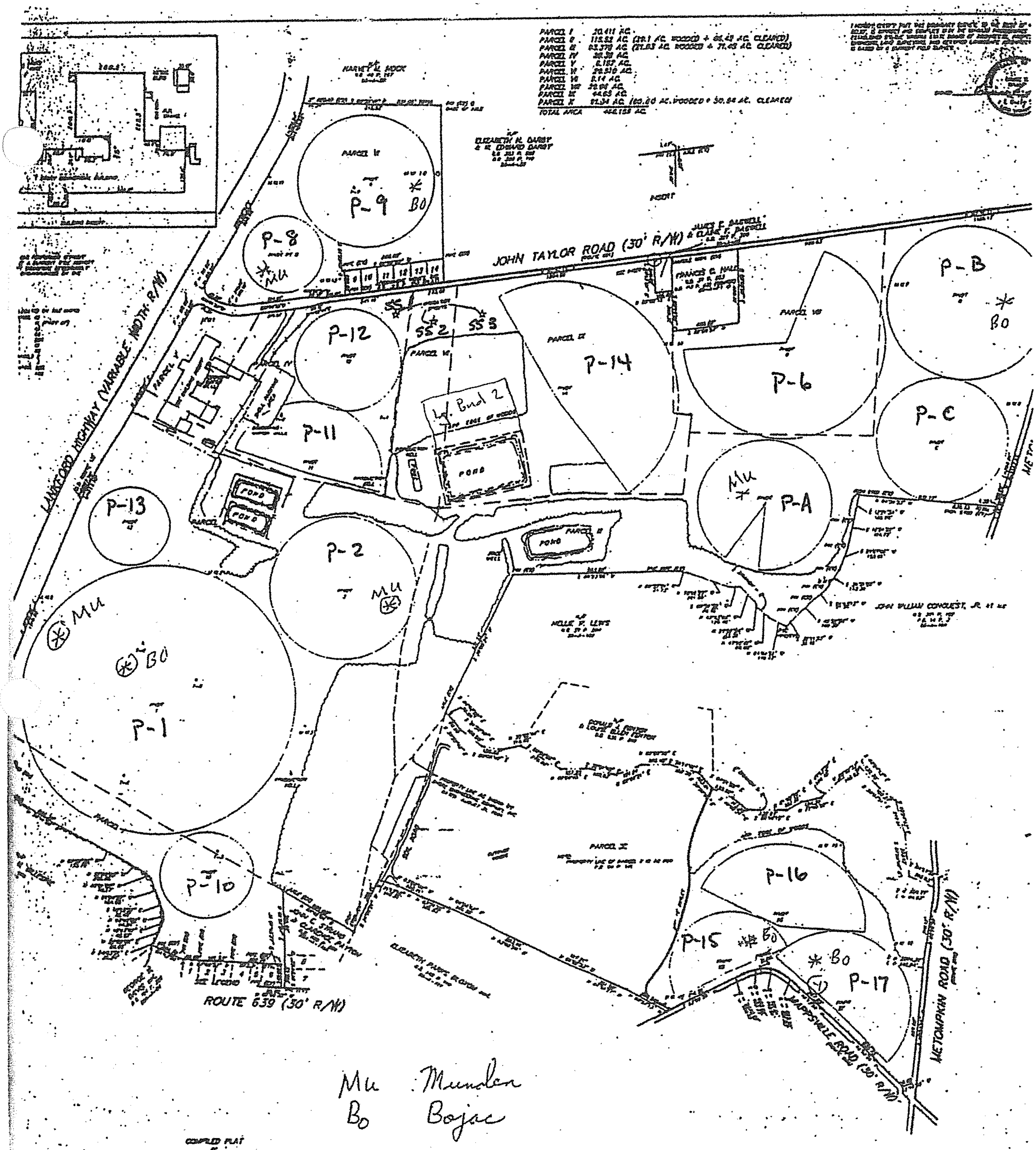


FIGURE 4
IRRIGATION PIVOT LOCATIONS

From VPA Permit VPA01060 2005-15

ATTACHMENT A

Summary of Currently Approved Land Application Sites

Permittee's Name: Eastern Shore Seafood Products, Inc.
Mappsville, VA

Owner's Name: Mr. Rick Meyers

Site Location	Field Designation*	Field Net Acres	Productivity Class
1		55.28	2
2		15.70	2
6		19.69	2
9		13.83	2
10		6.69	2
A		14.87	2
B		19.02	2
C		13.41	2
8		5.25	2
12		8.68	2
13		5.25	2
14		18.66	2
15		5	2
16		11.1	2
17		8	2
SS1		1.63	2
SS2		1.63	2
SS3		0.41	2

*The exact location of all sites can be found in the VPA application.

2. All land listed above is owned by the permittee.

When calculating the nutrients applied to a portion of a field, the permittee may use the following formula:

The amount of wastewater applied and the best estimate of the amount of the field that received the application, in acres, shall be used to calculate the nutrient loading.

The nutrient loading would be calculated by using the flow to the field on that day divided by the number of acres of that field receiving the flow.

Example:

If a pivot covered 60% of field number 1 on a particular day, then 60% of field 1 acreage is 33 acres. The flow would be divided by 33 to determine nutrient loading for field 1 on that day.

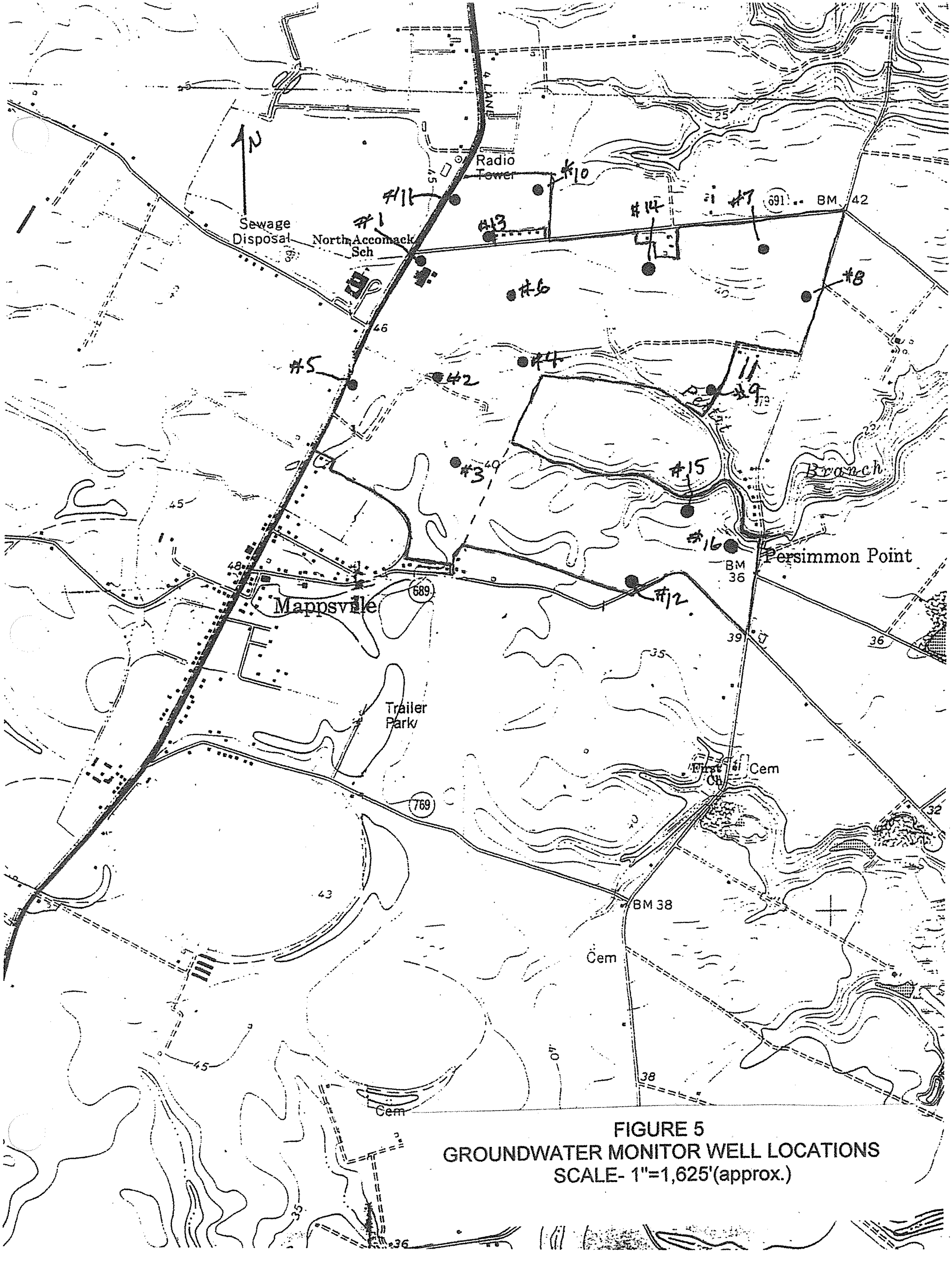


FIGURE 5
GROUNDWATER MONITOR WELL LOCATIONS
SCALE- 1"=1,625'(approx.)

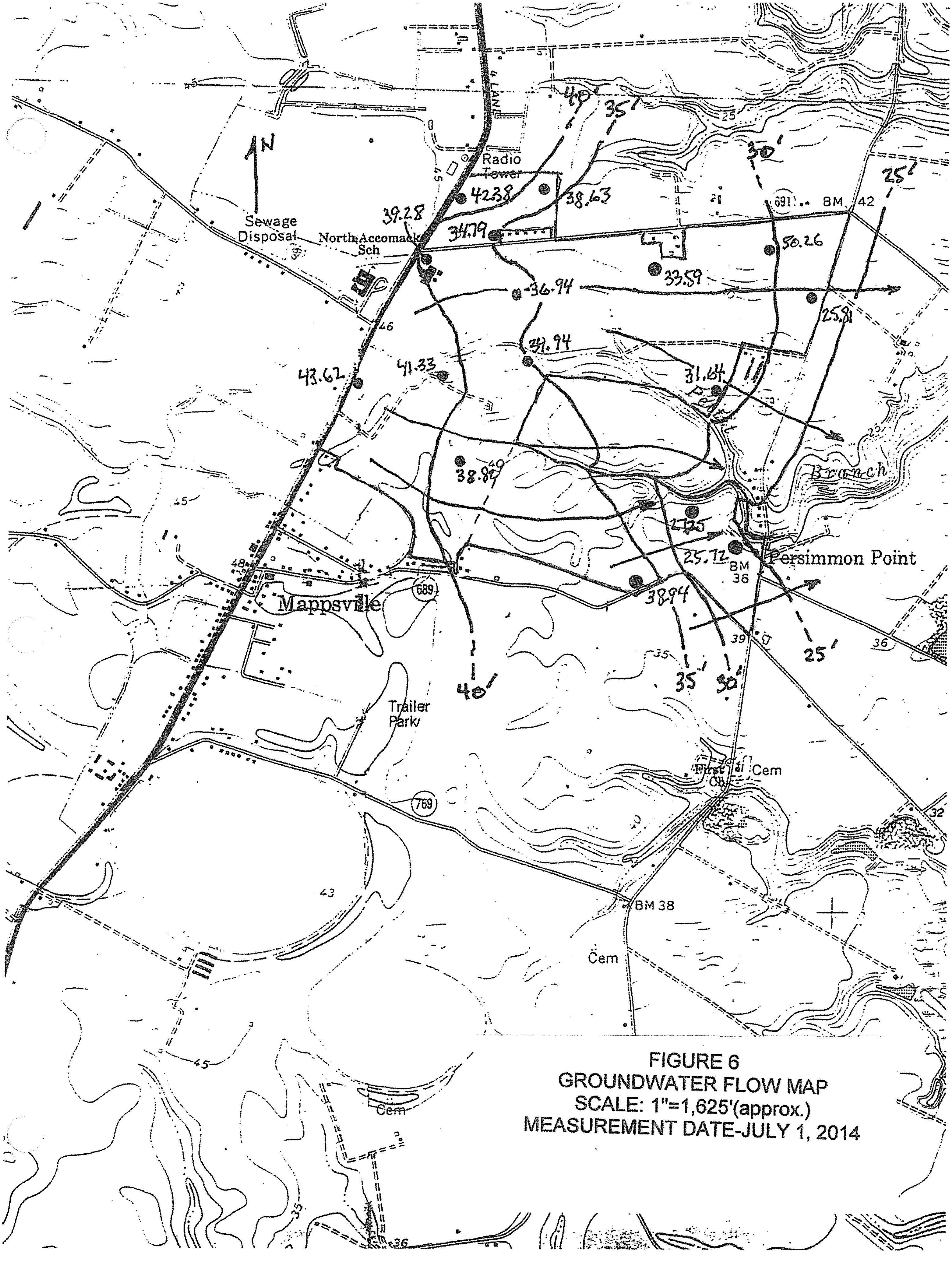


FIGURE 6
GROUNDWATER FLOW MAP
SCALE: 1"=1,625'(approx.)
MEASUREMENT DATE-JULY 1, 2014

VIRGINIA POLLUTION ABATEMENT PERMIT APPLICATION

FORM C

INDUSTRIAL WASTE

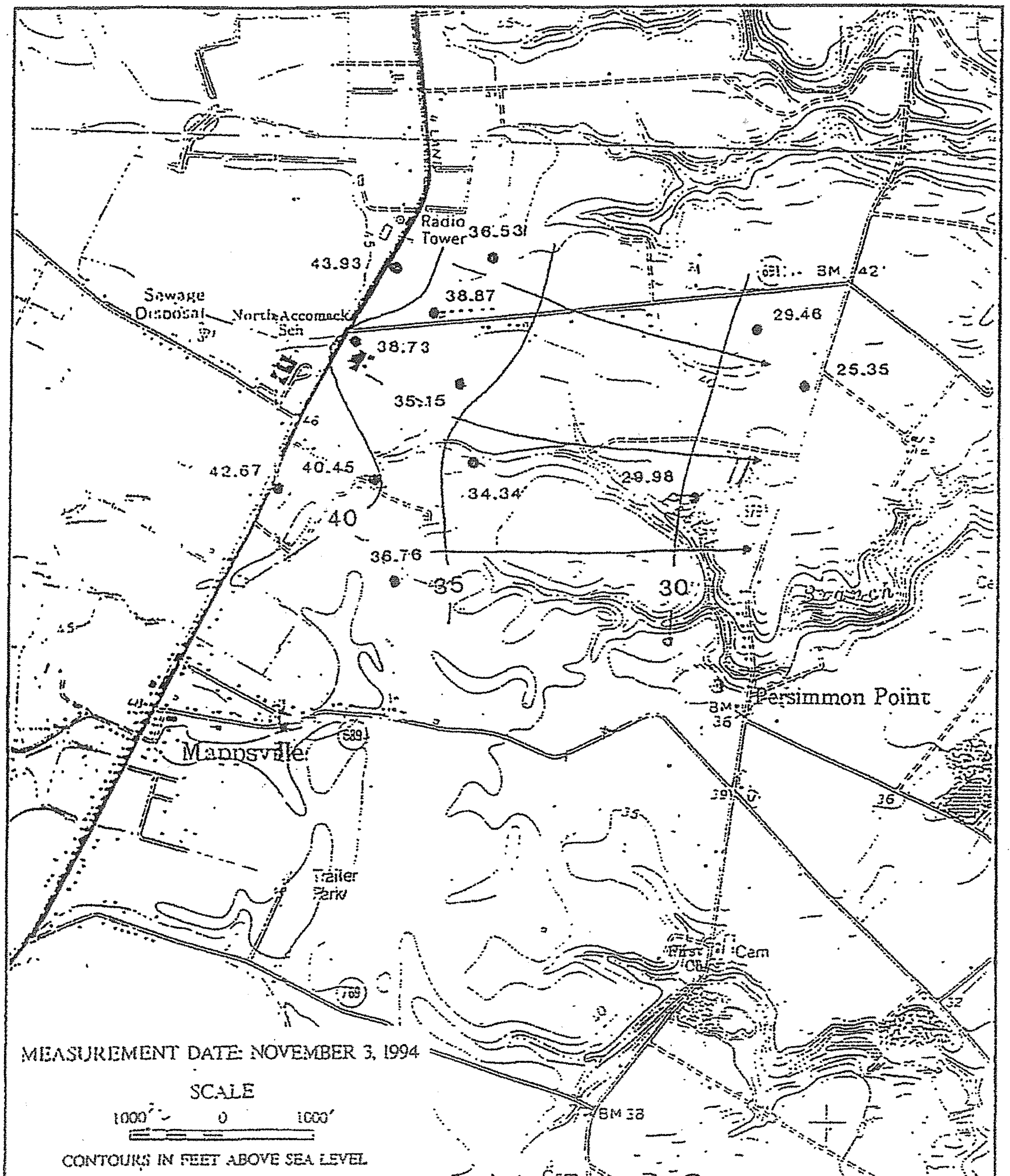
PART C-11 Land Application and Waste Handling Procedure

Facility Name: Eastern Shore Seafood Products, Inc

Items 1-12 pertain to the land application of industrial sludge/wastewater at frequent and infrequent rates. The applicant may request a waiver in writing for any of the required information if it is not pertinent to their operation.

1. For each land application site provide a topographic map of sufficient scale (5 foot contour preferred) clearly showing the location of the following features within 0.25 miles of the site. Provide a legend with approximate scale. (See General Instructions for map requirements.)

   a. *Proposed or existing groundwater monitoring wells* - See attached map
   b. *General direction groundwater movement* - See attached map
   c. *Water wells, abandoned or operating* - See attached maps
   d. *Surface water* - on topographic map
   e. *Springs* - n/a
   f. *Public water supply(s)* - n/a
   g. *Sink holes* - n/a
   h. *Underground and/or surface mines* - n/a
   i. *Mine pool (or others) surface water discharge points* - n/a
   j. *Mining spoil piles and mine dumps* - n/a
   k. *Quarry(s)* - n/a
   l. *Sand and gravel pits* - shown on topographic map where present
   m. *Gas and oil wells* - n/a
   n. *Diversion ditch(s)* - n/a
   o. *Agricultural drainage ditch(s)*
   p. *Occupied dwellings, including industrial and commercial establishments* - shown on map
   q. *Landfills or dumps* - n/a
   r. *Other unlined impoundments* - dug ponds shown
   s. *Septic tanks and drainfields* - at plant and at individual houses
   t. *Injection wells* - n/a
   u. *Rock outcrops* - n/a

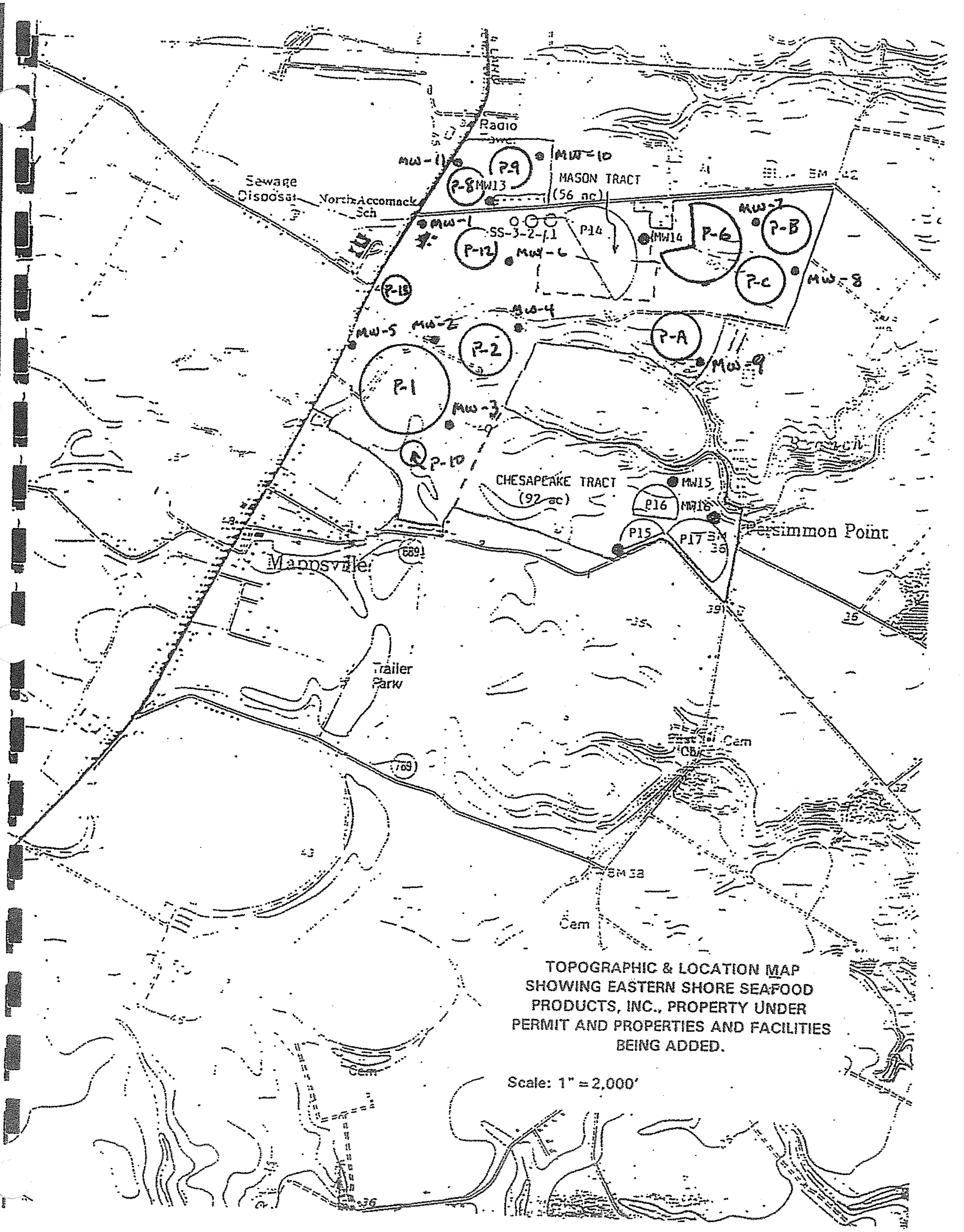


RKA	WATERTABLE CONTOUR MAP SHOWING GROUNDWATER FLOW DIRECTION EASTERN SHORE SEAFOOD PRODUCTS, INC. MAPPSVILLE, VIRGINIA	N	FIGURE NO. 1

WATERTABLE ELEVATIONS
NOVEMBER 3, 1994
EASTERN SHORE SEAFOOD PRODUCTS
MAPPSVILLE, VIRGINIA

WELL NO.	DEPTH TO WATER	TOC ELEV.	GW ELEV.
MW-1	8.65	47.38	38.73
MW-2	5.78	46.23	40.45
MW-3	5.44	42.20	36.76
MW-4	4.00	38.34	34.34
MW-5	5.25	47.92	42.67
MW-6	5.09	40.24	35.15
MW-7	15.00	44.46	29.46
MW-8	20.26	45.61	25.35
MW-9	11.66	41.64	29.98
MW-10	14.27	47.63*	36.53
MW-11	5.25	49.18	43.93
MW-13	9.57	48.44	38.87
MW-12		42.79	
MW-14		45.49	
MW-15		45.25	
MW-16		42.72	

*16 Feb. 96 Survey



TOPOGRAPHIC & LOCATION MAP SHOWING EASTERN SHORE SEAFOOD PRODUCTS, INC., PROPERTY UNDER PERMIT AND PROPERTIES AND FACILITIES BEING ADDED.

Scale: 1" = 2,000'

EASTERN SHORE SEAFOOD PRODUCTS, INC.
CURRENT ACREAGE UNDER IRRIGATION
1/31/04

SYSTEM	PVT. LGTH.	ACREAGE	END-GUN RADIUS	% USED	ENG-GUN ACREAGE	TOT. ACREAGE IRRIGATED
1	818.1'	48.25	100'	55.6	7.03	55.28
2	436.7	15.70	N/A		-	15.70
6	610	19.69	N/A		-	19.69
9	408	13.83	N/A		-	13.83
10	274.7	6.69	N/A		-	6.69
A	401.4	10.33	100'	69.7	4.54	14.87
B	475	16.26	100'	36.4	2.76	19.02
C	392.8	11.12	100'	35.8	2.29	13.41
8	240	5.25	N/A		-	5.25
12	317	8.68	N/A		-	8.68
13	240	5.25	N/A		-	5.25
14	733.5'	18.66				18.66
15	375	5				5.0
16	578	11.1				11.1
17	471	8				8.0
SS1	150	1.63				1.63
SS2	150	1.63				1.63
SS3	100	.41				.41
		207.48			16.62	224.1

NOTES:

1. Pivot lengths surveyed March 1994
2. Acreage of Pivots without end-guns includes a 30 foot wetted fringe not shown
3. End-gun aceage includes only area actually sprayed.
4. Systems that are not full-circle:

#6-240	14-172
	15-175
	16-166
	17-180

- v. *Soil Boring or test pits locations* - previously submitted. See Appendix C.
- w. *Subsurface drainage tile* - n/a

2. For each land application site provide a site plan of sufficient detail to clearly show any landscape features which will require buffer zones or may limit land application. Provide a legend and clearly mark the field boundaries and property lines. The following landscape features should be delineated. (See General Instructions for map requirements.)

   - a. *Drainageways* Shown on attached maps
   - b. *Rock outcrops* n/a
   - c. *Sink holes* n/a
   - d. *Drinking water wells and springs* n/a wells shown or with buildings shown on attached maps
   - e. *Monitoring wells* See attached map
   - f. *Property lines* See attached map
   - g. *Roadways* See attached topographic map
   - h. *Occupied dwellings* See attached topographic map
   - i. *Slopes (greater than 8% by slope class)* n/a
   - j. *Wet spots* See attached map
   - k. *Severe erosion (SCS designation)* n/a
   - l. *Frequently flooded soils (SCS designation)* n/a
   - m. *Surface Waters* See attached map

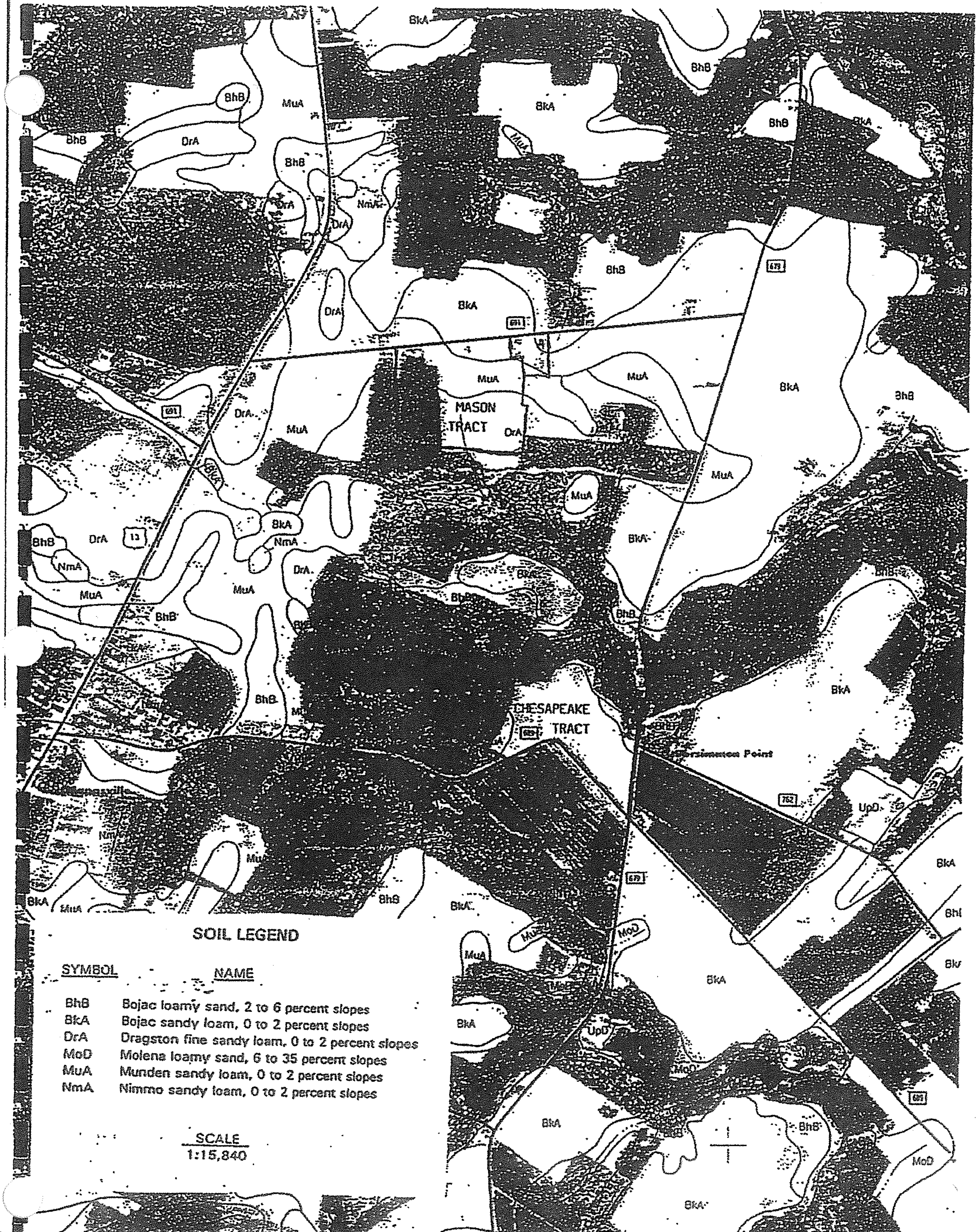
3. Provide a complete description of agronomic practices for each crop to be grown, on field-by-field basis including a nutrient management program, soil and/or plant tissue testing, and the coordination of tillage practices, planting and harvesting schedules and timing of land application. See attached soil moisture Evaluation for 2003 and nutrient management plan is being completed for separate submittal

4. Describe all land application methods and any equipment used in the process. Pumps and center pivots as shown and 3 solid set nozzles. See attached table.

5. Provide a detailed soil survey map, preferably photographically based, with the field boundaries clearly marked. (A USDA-SCS soil survey map should be provided, if available.) Soil survey attached. Also see Appendix C.

   Provide a detailed legend for each soil survey map which uses accepted USDA-SCS descriptions of the typifying pedon for each soil series (soil type). Complex associations may be described as a range of characteristics. Soil descriptions should include the following information. Attached; also see Appendix C

   - a. *Soil symbol*
   - b. *Soil series, textural phase and slope class*
   - c. *Depth to seasonal high watertable*
   - d. *Depth to bedrock*
   - e. *Estimated productivity group (for the proposed crop rotation).*



SOIL LEGEND

SYMBOL	NAME
BhB	Bojac loamy sand, 2 to 6 percent slopes
BkA	Bojac sandy loam, 0 to 2 percent slopes
DrA	Dragston fine sandy loam, 0 to 2 percent slopes
MoD	Molena loamy sand, 6 to 35 percent slopes
MuA	Munden sandy loam, 0 to 2 percent slopes
NmA	Nimmo sandy loam, 0 to 2 percent slopes

SCALE
1:15,840

Bojac Series

The soils of the Bojac series are very deep and well drained. They formed in moderately coarse textured sediments. They are on uplands. Slopes range from 0 to 6 percent.

Bojac soils are near Dragston, Munden, and Nimmo soils but do not have the gray in the solum than is typical of those soils.

Typical profile of Bojac fine sandy loam, 0 to 2 percent slopes, about 2 miles west of the junction of Highways Business U.S. 13 and VA 630 and 17 yards south of Highway VA 630, on Old Towne Neck:

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—9 to 32 inches; strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many distinct clay films and bridges between sand grains; moderately acid; gradual wavy boundary.

Bt2—32 to 42 inches; strong brown (7.5YR 5/8) loamy fine sand; weak coarse subangular blocky structure; very friable; many distinct clay films and bridges between sand grains; moderately acid; gradual wavy boundary.

C—42 to 80 inches; light yellowish brown (10YR 6/4) fine sand; few fine distinct strong brown (7.5YR 5/6) mottles; single grain; loose; moderately acid.

The solum thickness is 30 to 60 inches. The content of rock fragments is 0 to 5 percent throughout the soil. Reaction is extremely acid through slightly acid.

Some pedons have an A horizon that has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 through 6, and chroma of 1 through 4. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. It mainly is sandy loam, fine sandy loam, or loam in the upper part and loamy sand or loamy fine sand in the lower part. Some pedons have thin subhorizons of sandy clay loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 7, and chroma of 3 through 8. Mottles are in some pedons. It is sand or fine sand.

Dragston Series

The soils of the Dragston series are very deep and somewhat poorly drained. They formed in moderately coarse textured marine sediments. They are on uplands. Slopes range from 0 to 2 percent.

Dragston soils are near Bojac, Munden, and Nimmo soils. Dragston soils are gray in the solum, and Bojac soils are brown in the solum. Dragston soils are grayer in the upper part of the solum than Munden soils and are not as gray as Nimmo soils.

Typical profile of Dragston fine sandy loam, 0 to 2 percent slopes, about 135 yards north of Eyreville Road and 0.6 mile east of the intersection of Eyreville Road and Highway U.S. 13:

A—0 to 2 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable; common fine, medium, and coarse roots; strongly acid; abrupt wavy boundary.

E—2 to 6 inches; light yellowish brown (10YR 6/4) fine sandy loam; common medium distinct light gray (10YR 7/2) mottles; weak fine granular structure; friable; common fine, medium, and coarse roots; strongly acid; clear wavy boundary.

Bt—6 to 18 inches; yellowish brown (10YR 5/4) loam; common medium distinct light gray (2.5Y 7/2) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common very fine and fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Btg1—18 to 39 inches; light brownish gray (10YR 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many faint clay bridges between sand grains; strongly acid; gradual wavy boundary.

Btg2—39 to 45 inches; light brownish gray (10YR 6/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; few fine roots; many distinct clay films and bridges between sand grains; strongly acid; clear wavy boundary.

Cg—45 to 60 inches; light gray (10YR 7/2) fine sand; many medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; strongly acid.

The solum thickness is 25 to 50 inches. Reaction is very strongly acid through slightly acid. The content of rock fragments ranges from 0 to 2 percent in the solum and 0 to 10 percent in the Cg horizon.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

Some pedons have an Ap horizon that has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 4. It contains few or common high- and low-chroma mottles. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. It contains high- and low-chroma mottles. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 through 8. It contains low-chroma mottles. The Btg horizon has hue of 10YR or 2.5Y or is neutral. It has value of 4 through 6 and chroma of 0 through 4, or it is mottled. The Bt and Btg horizons are sandy loam, fine sandy loam, or loam.

Some pedons have a BC horizon that has hue of 10YR or 2.5Y or is neutral, has value of 5 or 6, and has chroma of 0 through 2. It contains high-chroma mottles. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The Cg or C horizon has hue of 10YR or 2.5Y or is neutral. It has value of 5 through 7 and chroma of 0 through 8. It contains high-chroma mottles. It is sand, fine sand, loamy sand, or loamy fine sand.

Munden Series

The soils of the Munden series are very deep and moderately well drained. They formed in moderately coarse textured sediments. They are on uplands. Slopes range from 0 to 2 percent.

Munden soils are near Bojac, Dragston, and Nimmo soils. Munden soils are gray in the lower part of the subsoil, and Bojac soils are brown in the lower part of the subsoil. Munden soils are not as gray in the upper part of the solum as Dragston and Nimmo soils are.

Typical profile of Munden sandy loam, 0 to 2 percent slopes, about 670 yards west of the junction of Highways VA 600 and VA 636 and 200 yards south of Highway VA 636:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

E—3 to 11 inches; pale brown (10YR 6/3) sandy loam; few medium faint yellowish brown (10YR 5/4) mottles; weak coarse granular structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

Bt1—11 to 23 inches; light yellowish brown (10YR 6/4) loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Bt2—23 to 38 inches; mottled yellowish brown (10YR 5/6) and light gray (10YR 7/2) loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many distinct clay films and bridges between sand grains; very strongly acid; clear wavy boundary.

Bt3—38 to 42 inches; mottled yellowish brown (10YR 5/6) and light gray (10YR 7/2) sandy loam; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; many distinct clay films and bridges between sand grains; strongly acid; clear wavy boundary.

C1—42 to 53 inches; mottled yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) sand; single grain; loose; strongly acid; gradual wavy boundary.

C2—53 to 60 inches; very pale brown (10YR 7/4) sand; common medium distinct strong brown (7.5YR 5/8) mottles; single grain; loose; medium acid.

The solum thickness is 25 to 45 inches. Reaction is very strongly acid through moderately acid. The Ap or A horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 through 4. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 through 6. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Bt horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 4 through 8, or it is mottled with high- and low-chroma mottles. It is sandy loam, fine sandy loam, or loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 2 through 8, or it is mottled with high- and low-chroma mottles. It is sand or fine sand.

Nimmo Series

The soils of the Nimmo series are very deep and poorly drained. They formed in moderately coarse textured marine and fluvial sediments. They are on uplands. Slopes range from 0 to 2 percent.

Nimmo soils are near Bojac, Dragston, and Munden soils. Nimmo soils are gray in the solum, and Bojac soils are brown. Nimmo soils are grayer in the upper part of the solum than Dragston and Munden soils.

Typical profile of Nimmo sandy loam, 0 to 2 percent slopes, about 0.6 mile west of the junction of Highway VA 634 and U.S. 13 and 100 yards north of Highway VA 634, across from the Virginia Department of Highways Residency Shop:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; friable; common fine, medium, and coarse roots; very strongly acid; clear wavy boundary.

Btg1—4 to 20 inches; light brownish gray (2.5Y 6/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium roots; many distinct clay films and bridges between sand grains; very strongly acid; gradual wavy boundary.

Btg2—20 to 32 inches; light brownish gray (10YR 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; many distinct clay films and bridges between sand grains; very strongly acid; gradual wavy boundary.

Btg3—32 to 43 inches; grayish brown (10YR 5/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Cg—43 to 65 inches; light brownish gray (10YR 6/2) fine sand; common medium distinct yellow (10YR 7/6) mottles; single grain; loose; strongly acid.

The solum thickness is 25 to 45 inches. Reaction is extremely acid through strongly acid. The content of pebble-size rounded rock fragments ranges from 0 to 3 percent.

The A or Ap horizon has hue of 10YR through 5Y, value of 2 through 5, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Btg horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 1 or 2. It mainly is sandy loam, fine sandy loam, or loam. Some pedons have thin subhorizons of sandy clay loam.

The Cg horizon has hue of 10YR through 5Y or is neutral. It has value of 4 through 7 and chroma of 0 through 8. It is sand, fine sand, loamy sand, or loamy fine sand.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Wheat	Irish potatoes	Snap beans	Cucumbers	Tomatoes	Tall fescue
		Bu	Bu	Cwt	Bu	Tons	Tons	Tons
AsE, AtD--------- Assateague	VIIs	---	---	---	---	---	---	---
BeB*------------ Beaches	VIIIw	---	---	---	---	---	---	---
BhB------------- Bojac	IIe	80	50	250	120	---	12	6
BkA, BoA-------- Bojac	I	110	45	300	160	---	15	8
CaA------------- Camocca	VIIIw	---	---	---	---	---	---	---
ChA------------- Chincoteague	VIIIw	---	---	---	---	---	---	---
DrA*------------ Dragston	IIw	120	40	290	110	---	10	7
FhB------------- Fisherman	VIs	---	---	---	---	---	---	---
FmD. Fisherman-Assateague								
FrB. Fisherman-Camocca								
MaA------------- Magotha	VIIIw	---	---	---	---	---	---	---
MoD------------- Molena	VIIs	---	---	---	---	---	---	---
MuA------------- Munden	IIw	115	50	300	150	---	15	8
NmA*------------ Nimmo	IVw	120	35	290	100	---	8	7
PoA------------- Polawana	VIw	---	---	---	---	---	---	---
SeA------------- Seabrook	IIIs	65	45	250	120	12	8.5	7
UD. Udorthents and Udipsamments								

* The yield for each column except tall fescue is based on the use of artificial drainage.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AsE------------- Assateague	0-4	Sand-----------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	4-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
D------------- Assateague	0-4	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	4-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
BeB*------------- Beaches	0-6	Sand-----------	SP	A-1, A-3	0	100	75-100	5-85	0-5	---	NP
	6-60	Coarse sand, sand, fine sand.	SP	A-1, A-3	0	100	75-100	5-85	0-5	---	NP
BhB------------- Bojac	0-6	Loamy sand-------	SM	A-2	0	95-100	95-100	50-100	15-30	<20	NP
	6-38	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	38-60	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
A------------- ojac	0-8	Sandy loam-------	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	95-100	55-100	30-60	<25	NP-7
	8-38	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	38-60	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
A------------- Bojac	0-9	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	95-100	55-100	30-60	<25	NP-7
	9-32	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	32-60	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
CaA------------- Camocca	0-85	Fine sand--------	SP, SP-SM, SM	A-3, A-1-b	0-3	95-100	90-100	60-90	4-10	---	NP
A------------- hincoteague	0-6	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	98-100	70-100	50-95	20-40	NP-20
	6-60	Loam, silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	98-100	85-100	60-95	25-45	7-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DrA------------- Dragston	0-6	Fine sandy loam	SM, SC, SM-SC, CL-ML	A-2, A-4	0	100	95-100	60-85	30-60	<20	NP-6
	6-45	Fine sandy loam, sandy loam, loam.	SM, SC, SM-SC, CL-ML	A-2, A-4	0	100	95-100	60-85	30-60	<25	NP-10
	45-60	Sand, loamy sand, fine sandy loam.	SM, SP-SM, SM-SC	A-1, A-2, A-3	0	95-100	85-100	35-70	5-30	<18	NP-7
FhB------------- Fisherman	0-6	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	6-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
FmD*:											
Fisherman-------	0-6	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	6-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
Assateague------	0-4	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	4-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
rB*:											
Fisherman-------	0-6	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	6-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
Camocca----------	0-85	Fine sand--------	SP, SP-SM, SM	A-3 A-1-b	0-3	95-100	90-100	60-90	4-10	---	NP
aA-------------- Magotha	0-5	Fine sandy loam	SM, SC, ML, CL	A-2, A-4, A-6	0	100	75-100	45-95	30-65	20-35	NP-15
	5-40	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	100	75-100	45-95	30-65	20-35	NP-15
	40-63	Coarse sand, fine sand, loamy fine sand.	SC, SP-SM, SM, SM-SC	A-1, A-2	0	100	75-100	35-99	10-35	10-25	NP-10
oD-------------- Molena	0-5	Loamy sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	55-95	5-15	---	NP
	5-46	Loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	98-100	55-95	7-25	---	NP
	46-72	Sand, coarse sand, gravelly sand.	SP, SP-SM	A-2, A-3	0-5	90-100	60-100	51-80	2-12	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
MuA----------------- Munden	0-8	Sandy loam--------	SM, SC, SM-SC	A-4	0	100	90-100	60-95	35-75	<22	NP-10
	8-42	Sandy loam, loam, fine sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	90-100	60-95	30-75	<30	NP-15
	42-60	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	50-90	5-35	<18	NP-7
NmA----------------- Nimmo	0-7	Sandy loam--------	SM, SC, SM-SC, ML	A-4	0	100	95-100	60-85	36-60	<22	NP-10
	7-43	Loam, fine sandy loam, sandy loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	100	95-100	60-95	30-75	<30	22-41
	43-65	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	95-100	50-80	5-35	<16	NP-7
PoA----------------- Polawana	0-35	Loamy sand--------	SM, SP-SM	A-2	0	100	98-100	70-90	10-35	---	NP
	35-60	Loamy fine sand, loamy sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	75-98	5-20	---	NP
SeA----------------- Seabrook	0-9	Loamy sand--------	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-99	5-25	---	NP
	9-85	Loamy fine sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-100	5-25	---	NP
UPD*: Udorthents.											
Udipsamments.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
AsE, AtD----------- Assateague	0-4	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.3	<2	Low--------	0.10	5	1	0-.5
	4-85	0-5	1.30-1.60	>20	0.02-0.06	5.6-7.8	<2	Low--------	0.10			
BeB*--------------- Beaches	0-6	0-1	---	>6.0	0.03-0.05	---	<2	Low--------	0.05	5	1	<.1
	6-60	0-1	---	>6.0	0.03-0.05	---	<2	Low--------	0.05			
BhB--------------- Bojac	0-6	3-8	1.20-1.50	6.0-20	0.05-0.10	3.6-6.5	<2	Low--------	0.17	3	2	.5-1
	6-38	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low--------	0.17			
	38-60	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	<2	Low--------	0.17			
BkA--------------- Bojac	0-8	3-8	1.20-1.50	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low--------	0.24	3	3	.5-2
	8-38	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low--------	0.17			
	38-60	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	<2	Low--------	0.17			
BoA--------------- Bojac	0-9	3-8	1.20-1.50	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low--------	0.24	3	3	.5-2
	9-32	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low--------	0.17			
	32-60	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	<2	Low--------	0.17			
CaA--------------- Camocca	0-85	5-12	1.45-1.60	>6.0	0.02-0.10	5.6-8.4	>16	Low--------	0.15	5	---	.5-2
ChA--------------- Chincoteague	0-6	10-35	1.20-1.50	0.2-2.0	0.02-0.07	5.6-7.3	>16	Moderate	0.32	5	---	2-10
	6-60	20-35	1.30-1.60	0.2-2.0	0.02-0.07	5.6-7.3	>16	Moderate	0.37			
DrA--------------- Dragston	0-6	4-12	1.20-1.50	2.0-6.0	0.08-0.15	4.5-5.5	<2	Low--------	0.20	4	3	1-2
	6-45	10-18	1.25-1.45	2.0-6.0	0.08-0.16	4.5-5.5	<2	Low--------	0.17			
	45-60	2-12	1.35-1.55	6.0-20.0	0.04-0.10	4.5-6.5	<2	Low--------	0.17			
FbB--------------- Fisherman	0-6	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.8	<2	Low--------	0.10	5	1	0-1
	6-85	0-5	1.30-1.60	>20	0.02-0.06	4.5-7.8	<2	Low--------	0.10			
FmD*:												
Fisherman--------	0-6	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.8	<2	Low--------	0.10	5	1	0-1
	6-85	0-5	1.30-1.60	>20	0.02-0.06	4.5-7.8	<2	Low--------	0.10			
Assateague-------	0-4	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.3	<2	Low--------	0.10	5	1	0-.5
	4-85	0-5	1.30-1.60	>20	0.02-0.06	5.6-7.8	<2	Low--------	0.10			
FrB*:												
Fisherman--------	0-6	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.8	<2	Low--------	0.10	5	1	0-1
	6-85	0-5	1.30-1.60	>20	0.02-0.06	4.5-7.8	<2	Low--------	0.10			
Camocca----------	0-85	5-12	1.45-1.60	>6.0	0.02-0.10	5.6-8.4	>16	Low--------	0.15	5	---	.5-2
MaA--------------- Magotha	0-5	10-26	1.20-1.50	0.6-6.0	0.13-0.22	4.5-7.3	>16	Low--------	0.28	5	---	2-8
	5-40	10-26	1.30-1.60	0.6-2.0	0.12-0.19	4.5-7.3	>16	Low--------	0.28			
	40-63	0-15	1.30-1.60	6.0-20	0.02-0.10	4.5-7.3	>16	Low--------	0.15			
MoD--------------- Molena	0-5	2-7	1.35-1.55	6.0-20	0.05-0.07	4.5-6.5	<2	Low--------	0.10	5	---	.5-2
	5-46	5-10	1.45-1.60	6.0-20	0.06-0.09	4.5-6.0	<2	Low--------	0.17			
	46-72	<5	1.45-1.60	6.0-20	0.03-0.05	4.5-6.0	<2	Low--------	0.15			
MuA--------------- Munden	0-8	4-16	1.20-1.35	2.0-6.0	0.08-0.16	4.5-6.0	<2	Low--------	0.20	4	3	1-2
	8-42	8-18	1.20-1.35	0.6-6.0	0.08-0.18	4.5-6.0	<2	Low--------	0.17			
	42-60	2-12	1.35-1.55	2.0-20.0	0.04-0.08	4.5-6.0	<2	Low--------	0.17			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	mmhos/cm					Pct
NmA---------------- Nimmo	0-7	4-14	1.20-1.35	2.0-6.0	0.08-0.16	3.6-5.5	<2	Low--------	0.20	4	4	1-5
	7-43	8-18	1.20-1.35	0.6-2.0	0.08-0.18	3.6-5.5	<2	Low--------	0.17			
	43-65	1-8	1.35-1.55	2.0-20.0	0.04-0.08	3.6-5.5	<2	Low--------	0.17			
PoA---------------- Polawana	0-35	2-12	1.30-1.55	6.0-20	0.07-0.12	4.5-7.3	<2	Low--------	0.10	5	8	3-12
	35-60	2-12	1.50-1.60	6.0-20	0.04-0.10	4.5-7.3	<2	Low--------	0.15			
SeA---------------- Seabrook	0-9	2-12	1.30-1.60	6.0-20	0.05-0.11	4.5-6.5	<2	Low--------	0.10	5	2	.5-2
	9-85	2-12	1.30-1.60	6.0-20	0.02-0.09	4.5-6.5	<2	Low--------	0.10			
UPD*: Udorthents.												
Udipsamments.												

* See description of the map unit for composition and behavior characteristics of the map unit.

f. *Estimated infiltration rate (surface soil)*
g. *Estimated permeability of most restrictive subsoil layer*

6. Representative soil borings for frequent land application and fixed spray irrigations, (to no less than 5 ft. or to the watertable) are to be conducted for the typifying pedon of each soil series (soil type) and the following data collected and tests performed. All results for infiltration and permeability tests should be enclosed. Provide information on the items below: Previously submitted prior to irrigation area approvals. See Appendix C.

   a. *Soil symbol*
   b. *Soil series, textural phase and slope class*
   c. *Depth to seasonal high watertable*
   d. *Depth to bedrock*
   e. *Estimated productivity group (for the proposed crop rotation).*
   f. *Estimated infiltration rate (surface soil)*
   g. *Estimated permeability of most restrictive subsoil layer*

7. Representative soil samples are to be collected for each major soil type and analyzed for the soil parameters indicated on Page C-11-6. Samples are to be taken at a depth of 0-6 in. Previously submitted; also see Appendix A (attached soil moisture evaluation) and Appendix C.

8. Land Area Determination:

   a. *Land area requirements are to be calculated and justified for each of the parameters listed below:* discussions of limiting factors previously submitted.

Parameters		*Method of Determining Required Area*
1.	*Nitrogen*	*Crop uptake, immobilization denitrification, leaching*
2.	*Phosphorous*	*Crop uptake, soil adsorption*
3.	*Potassium*	*Crop uptake*
4.	*Sulfur*	*Crop uptake, soil adsorption leaching*
5.	*Salts*	*Sodium Adsorption Ratio (SAR), leaching*
6.	*Carbon/Nitrogen Ratio*	
7.	*Metals (Ni, Cu, Zn, Pb, Co, Cd or other)*	*Cumulative loading for site life*
8.	*Anions (As, B, Chlorides)*	*Leaching, Soil Adsorption*
9.	*Calcium Carbonate Equivalency*	*Soil pH management*
10.	*Other Patameters (As needed or as requested by DEQ)*	

For each parameter and method of assimilation, (i.e. crop uptake, denitrification, immobilization, soil adsorption leaching, etc.), the required land area is to be justified by attaching calculations and appropriate references. Allowances for soil adsorption are to be justified by pertinent soil testing.

Provide calculations describing the nutrient value of the waste as lbs per dry ton or mg/l nitrogen (Pan), phosphorus (P_2O_5), potassium (K_2O), and any liming effects which may occur from land application. Annual water balance previously submitted.

b. Land area requirements for application of industrial wastewater orliquid sludge are to be determined and an annual water balance on a monthly basis developed integrating the following factors:

1. *Monthly precipitation*
2. *Monthly evapotranspiration data*
3. *Soil percolation rates (from subsurface permability data)*
4. *Monthly wastewater loading*
5. *Monthly storage requirement*
6. *Monthly storage input/drawdown*

9. Does the volume of wastewater generated as determined by the water balance in 8.b. exceed the hydraulic loading rate (inches/acre/year) of the soils? _____Yes __x___ No

If Yes, explain how excess loading will be disposed of:

____
____
____
____
____

10. Is the land application site owned by the applicant? _____ Yes __x___ No.

If No, answer question 11 and have the land owner complete the authorization form, Page C-11.5.

11. Complete page C-11.5 by providing the name(s), address(es), site locations and signatures of non-applicant land owner on whose property industrial waste will be applied (A separate approval will be required for each additional owner.): Irrigated property owned by Mr. Arthur Myers, Owners, Eastern Shore Seafood Products, Inc. The Myers Family (Arthur R, Jr./ Arthur R. III/ Mary)

AUTHORIZATION TO LAND APPLY WASTE
(Land Owner must sign and date this approval)

As land owner, I Authorize Eastern Shore Seafood Products, Inc. to land apply wastewater/sludge to my property in accordance with their VPA Form C application. This authorization will remain in effect until such time as I notify the Department of Environmental Quality in writing that this authorization has been withdrawn.

Name: Arthur L Myers, III

Address: P.O. Box 38

Mappsville, VA 23407

Telephone: 757-824-5651

Site Location(s) All Irrigation Systems/Pivots

Date: 2/16/04

Signature: [signature]

not needed if they own all the land. Put N/A if so.

SOIL SAMPLE TEST PARAMETERS FOR LAND APPLICATION SITES[1]

Industrial Operations	Sludge Freq. Below Ag. Rates[2]	Sludge Freq. at Ag. Rates[3]	Sludge Infrequent	Wastewater
Soil Organic Matter (%)		*		*
Soil pH (Std. Units)	*	*	*	*
Cation Exchange Capacity (mgq/100g)	*	*	*	*
Total Nitrogen (ppm)		*		*
Organic Nitrogen (ppm)		*		*
Ammonia Nitrogen (ppm)		*		*
Nitrate Nitrogen (ppm)		*		*
Available Phosphorus (ppm)	*	*	*	*
Exchangeable Potassium mg/100g	*	*	*	
Exchangeable Sodium (mg/100g)		*		*
Exchangeable Calcium (mg/100g)		*		*
Copper (ppm)		*		*
Nickel (ppm)		*		*
Zinc (ppm)		*		*
Cadmium (ppm)		*		*
Lead (ppm)		*		*
Chromium (ppm)		*		*
Manganese (ppm)		*		*
Particle Size Analysis or USDA Textural Estimate (%)		*		*
Hydraulic Conductivity (in/hr)				*

NOTE:
[1] Unless otherwise stated, analysis shall be reported on a dry weight basis.
[2] Less than 70% of agronomic nitrogen rates (annual basis).
[3] Test requirements will be adjusted based on previous test results
– Test for these parameters

APPENDICES

Appendix A - Technical Memo-Interception
Soil Moisture Evaluation for 2003
Logos Soils Consulting
Appendix B - EnviroScan/EnviroSmart Data
Appendix C - Hydrogeologic, Soil, & Chemical Data
Previoulsly Submitted
Appendix D - Nutrient Management Plan
To be submitted later

APPENDIX A
SOIL MOISTURE EVALUATION FOR 2003
LOGOS SOILS CONSULTING

RUSSNOW-KANE AND ASSOCIATES, INC.

11524 Jefferson Avenue
Newport News, Virginia 23601
(757) 595-5561 Fax (757) 599-0609

Memorandum

To:	Ms. Anhthu Nguyen, Env. Eng. Senior (DEQ)
From:	Art Russnow (RKA)
Copy:	file, 4038
Subject:	Eastern Shore Seafood Products, Inc. VPA Permit No. VPA 01060 Re-issuance Soil Moisture/Irrigation/Interception
Date:	February 23, 2004

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1. Interception of irrigated wastewater and its potential impact on the system was discussed in the 1995 application to modify the subject VPA Permit. Since that time informal discussions occurred with individuals involved with irrigated crops either from the agronomic standpoint or irrigation equipment suppliers. These discussions indicated that there were serious questions and concerns regarding the current operation of the wastewater irrigation system within the constraints of the current VPA permit.

2. Specifically, several of these individuals questioned using many small volume wastewater applications rather than larger volume applications (0.25 inches/hour versus some higher rate). This is because the loss due to direct evaporation of applied wastewater during irrigation and the loss of the portion if wastewater intercepted by the crop yields potentially much less water to the ground. At the same time, existing permit restrictions or conditions require the moisture content of the sandy top 4 inches of soil be low enough to accommodate an application considerably greater than the permitted rate insuring that there will be no run-off. The use of this "reservoir", taken together with the small amount of water actually reaching the ground almost insures that on a normal or average basis little to no water or nutrients reach the root zone, a critical factor for the crops as they try to take up water and nutrients from the soil. It has an extremely negative impact on crop viability and its ability to take up nutrients as well as water that then recycles to the atmosphere (transpiration).

3. Interception also leads to development of a wrong sense of how much of specific nutrients are being applied (in the sense that they are available to be taken up by the crop) and also a wrong sense of how the system is performing (i.e., good crop yield numbers versus lower crop yields which could be taken to indicate low nutrient uptake or conversely, based on calculated pounds of nutrients, that excessive applied nutrients are available to leaching. Actual crop yields lower than expected lead to applications of inorganic fertilizers which may leach more easily since they are generally applied early in the growing season. ESSP has also tracked some crop yields with various levels of inorganic fertilizer additions and gotten better crop yields. For instance, the 2003 corn crop on Pivots B and C received no additional nitrogen application other than that contained in the irrigation water. These fields yielded 83 bushels of corn per acre. Pivots 14, 6, and A received 63 additional pounds of nitrogen/acre and yielded 102 bushels per acre. Pivots 15, 16, and 17 received 147 additional pounds of nitrogen per acre and yielded 124 bushels per acre. This clearly indicates that due primarily to evaporation and interception, non-augmented crops do

not come close to yield expectations based on the VPA Permit Attachment B for type 2 soils. Note, however, that if up to 50% of the irrigated water does not reach the root zone, the calculated PAN rate will be 2 times higher than actual, leading to higher crop yield expectations based on the same table. It is possible that Attachment B could be replaced with yield expectations for irrigated, non-sludged crops.

4. For the reasons enumerated above, it was desirable to quantify how water moves through the soil using the EnvironScan soil moisture monitoring system. This knowledge is deemed import because it allows estimate of when recharge occurs or if it occurs at all due to irrigation during the growing season. The following soil moisture report provides information related to studies made over this past Summer and Fall. Should you have any questions regarding the equipment used or the results of the study, we will meet with you to discuss the results and answer questions.

Eastern Shore Seafood Products, Inc.

Soil Moisture Evaluation for 2003

By

Logos Soils Consulting
109 Brandon Lane
Franklin, Virginia 23851

Norris L. Powell

Norris L. Powell, President

For

Eastern Shore Seafood Products, Inc.
P. O. Box 38
Mappsville, VA 23407

9 February 2004

Table of Contents

Introduction

This report is an evaluation of irrigation, soils and crop tissue data collected in 2003 for the Eastern Shore Seafood Products, Inc. (ESSPI) wastewater reclamation project located near Mappsville, Virginia.

For the study of water movement into the soil after rainfall or irrigation the EnvironSCAN soil moisture monitoring system was used.

Probe Installation

Three (3) EnvironSCAN capacitance probes, manufactured by Sentek and described by Starr and Paltineanu (2002) were installed on a Bojac soil (2 probes) and Munden soil (1 probe). Each probe has eight (8) sensors measuring soil moisture at depths of four (4), eight (8), twelve (12), sixteen (16), twenty (20), twenty-eight (28), thirty-six (36), and forty-four (44) inches.

All probes are wired to a data logger and the data can be downloaded to a laptop computer as needed.

Soil Bulk Density Estimation

An estimation of the soil bulk density for each soil horizon down to 40 inches below the soil surface was made in accordance with the core method described by Blake and Hartge (1986) and Grossman and Reinsch (2002).

The two major soil types (Bojac and Munden) under irrigation were sampled at one location each. The major soil horizon designation for each soil type as defined by Peacock and Edmonds (1994) was used. Two core samples for each soil horizon were obtained.

The cylinder of the core sampler had an inside diameter of 5.4 cm and a height of 3 cm. The volume was calculated to be 68.7 cm^3. All samples were dried in an oven for at least 24 hours at $103^0 - 105^0C$. The sample and can weights were determined using an analytical balance capable of weighing to the nearest one hundredth of a gram. Soil bulk density was determined by dividing the dry soil weight by the volume of the core sampler cylinder.

The average maximum soil water holding capacity (MSWHC) was estimated by calculating the void space once the estimated soil bulk density was determined. The void space was calculated by substracting the soil bulk density from 2.65 (soil with no void space) and dividing the difference by 2.65 and multiplying by 100 to give percent (%) MSWHC.

All soil bulk density and MSWHC are reported in Table 1. Soil bulk density values are reported as low as 1.5 and as high as 1.83. The soils illustrate the classic principle of a finer textured soil impeding the flow of water into the lower coarser textured soil below, preventing deep drainage of the water into the groundwater below.

Crop Canopy Interception

Interception of rainfall and irrigation water by the corn crop canopy was measured by using a pan (60" L - X - 6" W – X - 4" H) and small rain gauges. The measurements were taken in the field under irrigation center pivot C where corn was being grown. Two pans were placed in an area under the pivot system where no corn crop was being grown and two were placed within the corn crop canopy. The pans were placed in a position so that during the irrigation cycle the same sprinklers on the center pivot system was watering the pan in the open area and canopy area. The pans were laid across two corn rows from the center of the balk on one side to the center of the balk on the other side of the two corn rows.

The small rain gauges were placed in the open area (2), in the row of the corn canopy (4) and in the balk of the row of the corn canopy (4). Of the two gauges placed in the open area one was placed in front of the corn row and one was placed in front of the balk of the corn row. The gauges placed in the corn row or balk of the corn row were placed 3-4 feet apart down the corn row/balk.

The data on interception of rainfall and irrigation water by the corn crop canopy are reported in Tables 2 and 3. With full corn crop canopy development in the studies conducted, the amount of irrigation water or rainfall water that reached the soil surface was between 31 to 56 percent of that applied.

Soil Analysis

Soil samples were taken at six (6) inch intervals from the surface to 30 inches below the surface in both irrigated and non-irrigated areas. The samples were analyzed for P, K, Ca, Mg, Na, pH, organic matter, Zn, Mn, Cu, B, and Cl by the A & L Eastern Agricultural Laboratories, Inc. Results for pH, Ca, Mg, Na, Cl, and Mn are reported in table 4.

Sodium, and to a lesser extent chlorine, is higher in the irrigated soils than in the non-irrigated soils. The differences are not alarming but it does indicate that the irrigation water is high in sodium. All soil data are reported in Appendix B

Irrigation Water Analysis

During an irrigation cycle water samples were collected at the pivot point, an open area in the field under the center pivot, and in the crop canopy under the center pivot. Data are reported in Table 5 with the laboratory reports given in Appendix C. The results are mixed.

There was a decrease in ammonia within the plant canopy but not in the open area. Under normal circumstances some decrease in ammonia within the open area would be expected. The nitrites showed the expected decrease and perhaps even more than expected within the plant canopy. A five to six fold increase of nitrates from the open and canopy areas samples as compared to the pivot point sample is difficult to explain. This is also true for the increase in TKN in the open area sample as compared to the pivot point sample.

If the open area and plant canopy area samples are compared the data does reflect what may be expected. Ammonia, nitrite, and TKN decrease in the canopy area as compared to the open area. The increase in nitrate in the canopy area could possibly be attributed to the concentration of nitrate in the water because of evaporation of water in the atmosphere.

Irrigation Water Quality Analysis

The three main irrigation ponds (2, 3 and 4) were sampled for irrigation water quality analysis. All samples were analyzed for Fe, Mn, sulfate, Cl, Fl, Cu, Na, nitrate, Ca, Mg, K, bicarbonate, carbonate, P, B, Al, Zn, pH, and total dissolved solids. From this information the saturation index, sodium, adsorption ration (SAR), soluble sodium percentage (SSP), and residual sodium carbonate (RSC) can be calculated. The samples were analyzed by the Water Quality Laboratory, Biological Systems Engineering, Virginia Tech, Blacksburg, Virginia.

Irrigation water quality analysis data for crucial items are given in Table 10. All data are reported in Appendix A.

All three ponds (ponds 2, 3, and 4) have irrigation water quality problems. Pond 2 is much worse than ponds 3 and 4. The main problems are total dissolved solids, sodium, bicarbonate, and nitrate. Total dissolved solids, sodium, and nitrate are approximately 35 to 40 % less in ponds 3 and 4 than in pond 2. Bicarbonate is approximately 64% less in ponds 3 and 4 than in pond 2. While these elements/ions are elevated they do not present a problem for this application. The total dissolved solids are made up primarily from sulfate, chloride, sodium, and bicarbonate. Because of the coarse texture of the soils sodium does not cause a problem for this application. Bicarbonates are not a problem because no fertilizer material such as phosphorus will be injected into the irrigation water. The other items are considered essential elements for crop production and while present in great amounts do not present a threat to crop production.

While SAR, SSP, and RSC are well above maximum recommended levels for irrigation water quality they are not a problem because of these coarse textured soils that are present (Bojac and Munden). On finer textured soils they would be a serious problem.

Plant Analysis

The corn crop was sampled several times during the growing season to determine if there might be any elemental deficiency during the growing season.

Tissue samples were taken from four field locations each time. Tissue samples for the Munden (sample 1) and Bojac (sample 2) soils were taken under pivot C where no N fertilizer was added to the crop after planting. A tissue sample was taken from the Bojac soil (sample 3) under pivot 17 where 147 lbs/acre of N fertilizer was added to the corn crop after planting. The fourth tissue sample was taken from a Munden soil under pivot 6 where 63 lbs/acre of N fertilizer was added to the corn crop after planting.

Results are reported in Table 6.

Nitrogen was sufficient or high in the plant tissue throughout the growing season where N fertilizer was added to the crop at planting. Nitrogen was sufficient to low to deficient where no N fertilizer was applied at planting. This indicates that there is some benefit to added N fertilizer early in the growing season especially since nitrogen added in the irrigation water could be lost by crop interception/volatilization.

Application of additional N fertilizer to the corn crop at planting pursuant to the requirements of the Soil Nutrient Management Plan would be beneficial.

Magnesium and Zinc were low or deficient throughout the growing season. This indicates that these two elements should be applied to the corn crop early in the growing season either as a preplant fertilizer (Zn) or as a foliar applied fertilizer (Mg and Zn).

As expected, sodium was sufficient to very high in the tissue throughout the growing season.

All tissue data are reported in appendix D.

Field Capacity (FC) Determination *in situ.*

Field capacity was determined for the Bojac and Munden soils in accordance with Cassel and Nielsen (1986) and Romano and Santini (2002). Table 7 shows the results of this FC estimation. Soil moisture content and the per cent soil saturation for each sensor on each soil moisture probe are reported for 48 and 96 hours after "free drainage". In most cases the percent saturation did not change significantly between 48 and 96 hours.

Field capacity for the Bojac soil appears to be between 27.2 to 31.2% down to 32 inches below the soil surface. For the Munden soils the values would average between 29 and 32% down to 32 inches below the soil surface. These values are higher than those used for the current soil moisture monitoring plan (SMMP) as outlined by Russnon-Kane and Associates, Inc. (1997). The present value for irrigation initiation according to the SMMP is 5 centibars which is approximately 22 to 23% soil moisture.

The graphs showing soil moisture status during the time of this FC evaluation are presented in Appendix E.

Irrigation Analysis

Table 8 provides an analysis of irrigation for the Bojac and Munden soils during the period of 25-26 August, 2003. The data upon which Table 8 is based are plotted in the graphs in Appendix F. The analysis of water movement through the soil from irrigation indicates that water did not move below 24 inches below the soil surface with the application of up to one inch of irrigation water. This means the water remained well within the crop (corn) root zone.

Soil Water Content After Heavy Rainfall

Soil water content after heavy rainfall on 3 September 2003 (8 inches +) is reported in table 9. Soil saturation did not occur during this storm event although water did move well below the lower sensor (44 inch depth.) because field capacity was exceeded.

Data for this event are plotted in graphs shown in Appendix G.